

PROCESS CARTRIDGE AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to a process cartridge which includes cleaning means for removing toner used for image formation by an electrophotographic process, and to an image forming apparatus.

10 Related Background Art

 Conventionally, an image forming apparatus using an electrophotographic image forming process adopts a process cartridge system. In the process cartridge system, an electrophotographic

15 photosensitive member and process means acting on the electrophotographic photosensitive member are integrated into a cartridge which is provided detachably attachable to a main body of the electrophotographic image forming apparatus.

20 According to this process cartridge system, a user of the image forming apparatus can perform maintenance of the apparatus independently without relying upon a serviceman. Thus, operability can be improved remarkably. Such a process cartridge system is

25 widely used in the field of the electrophotographic image forming apparatus.

 In addition, a single process cartridge is

often selected for an image forming apparatus, in which case a large cleaning frame is used. Even in the case in which plural kinds of process cartridges can be selected, a cleaning frame is enlarged as an
5 amount of toner is increased. The enlarged cleaning frame is also adopted even if the amount of toner is small.

However, when it is attempted to increase a capacity for containing toner, not only a toner frame
10 of a large capacity process cartridge but also a cleaning frame has to be enlarged. In accordance with the increase in the size of the cleaning frame, the process cartridge is enlarged. Moreover, a size of an image forming apparatus main body is also
15 increased in order to receive the enlarged process cartridge.

In addition, in the case in which a cartridge of a small capacity type with a small amount of toner is set for the enlarged cartridge, even if the
20 cleaning frame still has room in its capacity for receiving the toner, the cleaning frame has to be replaced once the toner contained in the toner frame is fully consumed. Thus, for a user who performs a large quantity of image formation, the number of
25 times of cartridge replacement increases. On the other hand, for a user who performs a small quantity of image formation, the large capacity process

cartridge is expensive, and the user continues to use one process cartridge for a long period of time. Thus, image degradation or the like is liable to occur.

5

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a cleaning device of two types, namely, a first cleaning device provided with carrying means
10 for carrying toner to a cleaning frame and a second cleaning device not provided with the carrying means, each being detachably attachable to an identical apparatus, to thereby allow a user to select a cleaning device of a long life or a low price
15 depending on usage.

In addition, it is another object of the present invention to provide a process cartridge of two types, namely, a first process cartridge using a first cleaning frame provided with carrying means for
20 carrying toner to a cleaning frame and a second process cartridge using a second cleaning frame not provided with the carrying means, each being detachably attachable to an identical apparatus, to thereby allow a user to select a process cartridge of
25 a long life or a low price depending on usage.

In order to attain the above-mentioned objects, the present invention provides a process cartridge

and an image forming apparatus, the process cartridge including: an image bearing member; developing means; a toner frame which contains toner to be supplied to the image bearing member; cleaning means which
5 removes toner remaining on the image bearing member; and a cleaning frame which receives the toner on the image bearing member recovered by the cleaning means, an opening being formed in the cleaning frame. The process cartridge and the image forming apparatus are
10 characterized in that at least one of a first cleaning device, which is provided with waste toner carrying means for carrying the toner of the cleaning frame in the opening and a second cleaning device, which is not provided with the waste toner carrying
15 means but is provided with a sealing member in the opening, is constituted, and the process cartridge provided with the first cleaning device and the process cartridge provided with the second cleaning device are each detachably attachable to a main body
20 of an identical image forming apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view showing an embodiment of an electrophotographic image forming apparatus
25 according to the present invention;

Fig. 2 is a side sectional view showing an embodiment of a process cartridge according to the

present invention;

Fig. 3 is a perspective view showing an embodiment of a cleaning unit according to the present invention;

5 Fig. 4 is a perspective view showing a positional relation among waste toner carrying means, driving means, and a partition member according to the present invention;

Fig. 5 is a sectional view showing engagement
10 of a waste toner carrying member and a drive member according to the present invention;

Fig. 6 is a side sectional view showing another embodiment of the process cartridge according to the present invention; and

15 Fig. 7 is a longitudinal sectional view showing through-hole sealing which is used in another embodiment of the process cartridge according to the present invention.

20 DESCRIPTION OF THE PREFERRED EMBODIMENTS

First, an embodiment of an image forming apparatus (laser beam printer) to which the present invention is applied will be described with reference to Fig. 1.

25 An image forming apparatus A forms an image on a recording medium (e.g., recording paper, an OHP sheet, or cloth) with an electrophotographic image

forming process.

A predetermined voltage is applied to a charging roller 8, which is in contact with an electrophotographic photosensitive member of a drum shape (hereinafter referred to as "photosensitive drum") 7, to uniformly charge the photosensitive drum 7, and the photosensitive drum 7 is exposed to light using an exposure device 1, which uses a laser beam source or the like, to form a latent image thereon.

10 Toner contained in a toner frame 11 is deposited on a portion of the photosensitive drum 7, where the latent image is formed, by developing means 9 to form a toner image.

On the other hand, in synchronization with the formation of the toner image, a recording medium 2 set in a sheet feeding cassette 3a is conveyed by a pickup roller 3b and a conveyance guide 3c. Timing for appropriately transferring the toner image on the photosensitive drum 7 to the recording medium 2 is taken by registration rollers 3, and the recording medium 2 is conveyed to a transfer roller 4 at appropriate timing. The toner image formed on the photosensitive drum 7 provided in a process cartridge B is transferred to the recording medium 2 by

25 applying a voltage to the transfer roller 4 serving as transfer means.

Thereafter, the recording medium 2, to which

the toner image has been transferred, is conveyed to fixing means 5 by a conveyance guide 3f. This fixing means 5 has a drive roller 5c and a fixing roller 5b incorporating a heater 5a. The fixing means 5

5 applies heat and pressure to the recording medium 2, which passes through the fixing means 5, to fix the transferred toner image. Then, the recording medium 2 is conveyed by a discharge roller pair 3i to be discharged to a discharge tray 6.

10 (First embodiment)

Next, the process cartridge B will be described.

Figs. 2 to 5 show the process cartridge B including waste toner carrying means for forcibly carrying waste toner, which is removed from the
15 photosensitive drum 7 by a cleaning blade 10a, into a cleaning frame 13.

A laser beam corresponding to image information from an optical system 1 is irradiated on the photosensitive drum 7 via an exposure opening 1e to
20 form a latent image.

Toner in a toner container 11 is carried to a developing roller 9a by rotation of a toner carrying member 9c. Then, the developing roller 9a incorporating a fixed magnet is rotated, while a
25 toner layer is formed on a surface of the developing roller 9a. The toner layer is given a triboelectric charge by a development blade 9b that regulates an

amount of toner on a circumferential surface of the developing roller 9a and gives a triboelectric charge. Such toner is supplied to a development area of the photosensitive drum 7. Then, the toner is

5 transferred to the photosensitive drum 7 in correspondence with the latent image to thereby visualize the toner image.

Subsequently, a voltage of a polarity opposite to that of the toner image is applied to the transfer

10 roller 4 to transfer the toner image formed on the photosensitive drum 7 to the recording medium 2, and then waste toner remaining on the photosensitive drum 7 is removed by the cleaning blade 10a which is attached to a support member. Then, the removed

15 waste toner is recovered in the cleaning frame 13.

In addition, Fig. 3 shows a perspective view of a cleaning unit C of the process cartridge. The cleaning unit C includes the photosensitive drum 7, cleaning means 10 including the cleaning blade 10a,

20 and the cleaning frame 13 mounted with the cleaning means 10 and the charging roller 8. The cleaning unit C is rotatably coupled with a development unit D, which holds the toner frame 11 having a toner containing portion for containing toner and

25 developing means such as the developing roller 9a, using a coupling member 22, whereby the process cartridge B is constituted. Further, the process

cartridge B is removably mounted to cartridge mounting means provided in a main body of the image forming apparatus.

Note that a drum shutter member (not shown) is
5 attached to the main body of the image forming apparatus so as to cover the photosensitive drum 7 for the purpose of preventing exposure to light for a long time period, contact with a foreign matter, and the like when the process cartridge B is removed from
10 the main body of the image forming apparatus.

Next, a detailed structure of a first cleaning unit C of this embodiment will be described.

Fig. 4 shows a detail view of waste toner carrying means 16 provided in the cleaning frame 13
15 of the process cartridge B. Fig. 5 shows an enlarged view of a drive portion of the waste toner carrying means 16. The cleaning frame 13 has a through hole 24, which serves as an opening for setting the waste toner carrying means 16, in a longitudinal direction
20 thereof. The waste toner carrying means 16 includes a waste toner carrying member 16b and a drive member 16a serving as a driving force receiving member for driving the waste toner carrying member 16b. This waste toner carrying member 16b rotates to forcibly
25 carry waste toner to the cleaning frame 13. In addition, the driving force of the waste toner carrying member 16b is transmitted from a drum gear

crimped to the photosensitive drum 7 while being decelerated via idler gears 16c, 16d, and 16e. The drive member 16a is attached to an end face in a longitudinal direction of the process cartridge B while being pierced through the through-hole 24 provided on a side of the cleaning frame 13 from an outside to an inside of the cleaning frame 13. Further, a seal member 25 such as an oil seal is provided in the through-hole 24.

10 Note that a partition plate 17 acting as eaves is attached above the waste toner carrying member 16b so as to prevent the waste toner carried by the waste toner carrying member 16b from falling on the waste toner carrying member 16b to cause a drive failure due to adhesion of toner.

15 Next, an operation for carrying waste toner into the cleaning frame 13 with the waste toner carrying means 16 will be described in detail. After image formation, waste toner remaining on the

20 photosensitive drum 7 is removed by the cleaning blade 10a which is in abutment against the photosensitive drum 7. The removed waste toner is gradually accumulated in the cleaning frame 13 but is liable to be recovered in the vicinity of a lower

25 part of the cleaning blade 10a. Thus, the waste toner recovered in the vicinity of the lower part of the cleaning blade 10a is forcibly carried in a

downstream direction of the cleaning frame 13 by the rotation of the waste toner carrying member 16b. The waste toner forcibly carried into the cleaning frame 13 is deposited in a vertical downward direction in the cleaning frame 13. However, since the waste toner is in a state in which a bulk density thereof is increased, an amount of the waste toner to be received in the cleaning frame 13 can be made larger than an amount of waste toner to be received in a cleaning frame of the same volume.

A portion of the waste toner forcibly carried into the cleaning frame 13 is carried in a direction of the waste toner carrying means 16 again by a circulating flow generated in the cleaning frame 13 by the toner carrying operation. When the circulated waste toner is deposited on the waste toner carrying member 16b, a driving force of the waste toner carrying member 16b is increased to cause an increase in load with respect to a drive source (not shown). Thus, in order to prevent the circulated waste toner from depositing on the waste toner carrying member 16b, the partition member 17 is provided above the waste toner carrying member 16b such that the circulated waste toner is deposited on the downstream side in the toner carrying direction.

In addition, a drive source for giving a driving force to the drive member 16a from the main

body of the image forming apparatus is the same as the drive source giving a driving force to the photosensitive drum 7. When the waste toner removed by the cleaning blade 10a is carried into the
5 cleaning frame 13, fluctuation in torque may occur with respect to the drive source, causing driving fluctuation with respect to the photosensitive drum 7. Thus, an image failure due to the fluctuation in torque can be prevented by adopting a torque limiter
10 or the like such that a driving torque transmitted from the drive source to the photosensitive drum 7 is always fixed at the time of image formation.

With the above-mentioned structure, by using the waste toner carrying member 1b, it is possible to
15 increase a bulk density of the waste toner in the cleaning frame 13 and forcibly carry the waste toner to the downstream side of the cleaning frame, thereby allowing much waste toner to be received in the cleaning frame compared with a frame body of the same
20 volume. Further, since the partition plate 17 is used, the waste toner received in the cleaning frame 13 never prevents the drive of the waste toner carrying member.

Note that the waste toner is carried to the
25 downstream side of the cleaning frame by rotating the waste toner carrying member used for the cleaning unit C used in the embodiment during the image

forming operation. However, the same effect can be obtained even if the waste toner is carried before image formation, during an intermittent operation of the image formation, after the image formation, or
5 according to an instruction from a user.

Alternatively, in the case in which drive sources giving driving forces to the photosensitive drum 7 and the drive member 16a are provided separately, or in the case in which a mechanism for
10 mechanically switching a drive mechanism of the same drive source is provided, an effect is achieved regarding the problem of the fluctuation in torque with respect to the photosensitive drum.
(Second embodiment)

15 Figs. 6 and 7 show a process cartridge of a low price and low capacity type using a second cleaning unit C' which does not adopt the waste toner carrying member 16 used in the cleaning unit C described in the first embodiment. Note that the same components
20 as those in the first embodiment are denoted by the same reference symbols.

The cleaning unit C' includes the photosensitive drum 7, the cleaning frame 13, the cleaning means 10 including the cleaning blade 10a.
25 The cleaning unit C' is rotatably coupled with the development unit D using the coupling member 22, whereby the process cartridge B is constituted.

In the cleaning unit C', the through-hole 24 serving as an opening for mounting a waste toner carrying member is unnecessary because the waste toner carrying member 16 is not adopted. Thus, a
5 toner sealing member 23 is pressed in or welded to the through-hole 24 provided in the cleaning frame 13 to seal the through-hole 24 such that waste toner does not leak therefrom.

Instead of forming the toner sealing member 23
10 with the same material as the cleaning frame, it is possible to form the toner sealing member 23 with an elastic body in order to make welding work easy.

In addition, the toner sealing member 23 is formed so as to be recessed toward the inside of the
15 cleaning frame 13 from the external circumferential surface thereof, and the drive member 16a is received in the central part of the toner sealing member 23. Consequently, it becomes possible to provide a process cartridge which, even in the case in which
20 the drive member 16a is provided in the main body of the image forming apparatus, compatibility is improved in mounting and dismounting the cleaning unit C'.

Note that the toner frame 11 described in this
25 embodiment is the same as the toner frame 11 described in the first embodiment. However, since the process cartridge is of a low price and low

capacity type, an amount of toner contained in the toner frame 11 is smaller than that in the toner frame 1 of the first embodiment.

Thus, the process cartridge using the cleaning unit C', in which the waste toner carrying member of the cleaning unit C is sealed, has a simplified cleaning unit structure. Therefore, it is possible to provide a process cartridge of a low price.

In addition, since the cleaning frames used in the cleaning units C and C' are the same, sizes of the process cartridge provided with the cleaning unit C and the process cartridge provided with the cleaning unit C' are the same whether the capacity for receiving toner is large or small. Thus, the process cartridges are detachably attachable to the main body of an identical image forming apparatus, respectively. Accordingly, it is sufficient to select one of the process cartridges depending on usage.

In the first and second embodiments, waste toner on the surface of the photosensitive drum 7 is removed. However, the same effect can be obtained even if a cleaning device, which removes waste toner remaining on a surface of not only the photosensitive drum but also a sheet conveyor belt, an intermediate transfer member, or the like, is used as a cartridge.

In addition, the same effect can be obtained

even if a cartridge is separately provided from a developer or separately provided from an image bearing member and a developer.